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(71) Applicant
Pierce J Maher
1 St Georges Villas, Inchicore, Dublin 8, Ireland

(72) Inventor
Pierce J Maher

(74) Agent and/or Address for Service
D Young & Co
10 Staple Inn, London, WC1V 7RD, United Kingdom

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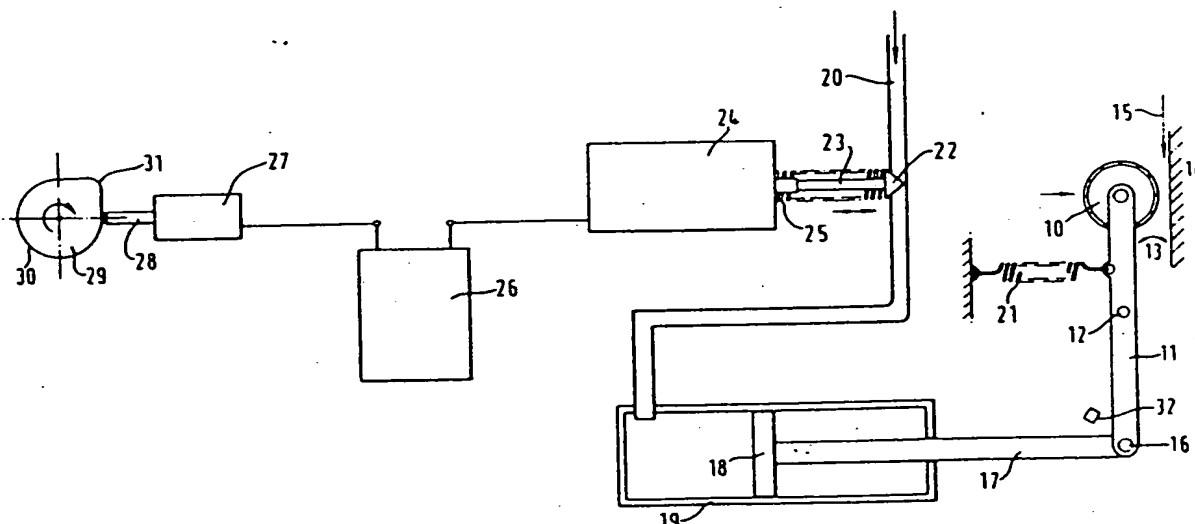
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(54) Apparatus for perforating sheet material

(57) The apparatus comprises a perforating roller 10 mounted on an arm 11 pivotable about point 12 to allow the roller 10 to be pressed by a spring 21 into engagement with a backing member 14. The arm 11 is pivotally connected to a piston rod 17 housed in a pneumatic cylinder 19, fed with compressed air fed via a pipe 20 controlled by a solenoid operated valve member 22. The solenoid 24 is controlled by a unit 26 which, *inter alia*, counts the number of pulses generated by the projection 31 of a cam 29 via a micro switch 27. The cam 29 rotates once for each sheet length of paper drawn past the backing member 14. In the preparation of docket books having two perforated sheets interposed by single unperforated sheets, the control unit 26 is set to two so that the cam 29 rotates twice before the unit 26 actuates the valve to drive the piston rod 18 to the right thereby lifting the roller 10 from the backing material 14. After a predetermined period equal to the time taken for a sheet to pass the roller 10, the valve 24 is closed the spring 21 biasses the roller 10 against the backing member 14 thereby perforating the sheet material. Local weakening by other means, e.g. cutting partially through the sheet is contemplated.



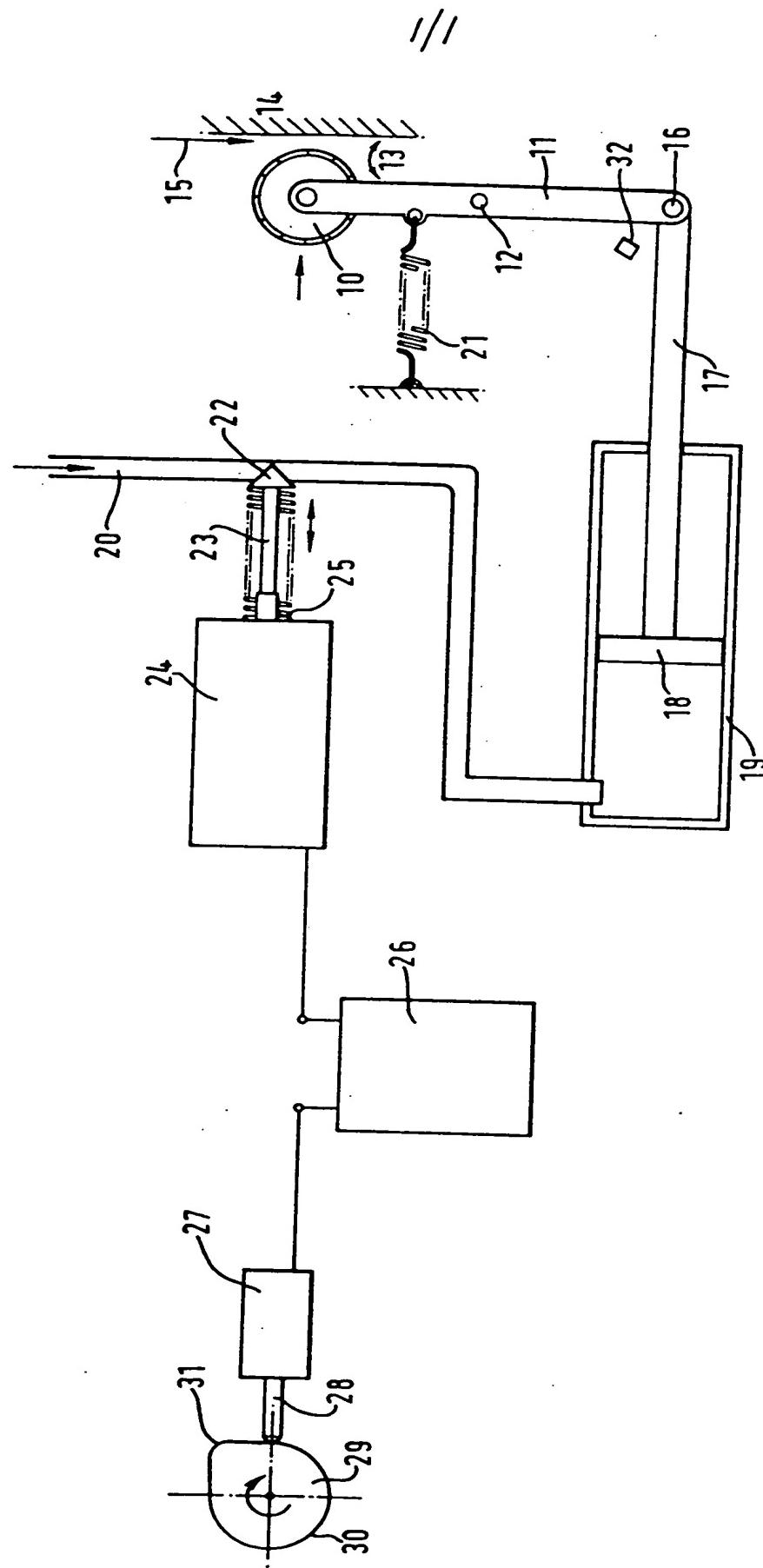
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"APPARATUS FOR PERFORATING SHEET MATERIAL"

This invention relates to an apparatus for perforating, slitting, top scoring or otherwise locally weakening sheet material.

The invention is especially, but not exclusively useful in the manufacture of so-called docket books, i.e. books consisting of a number of sets of sheets with all but one sheet of each set being torn out leaving a single sheet of each set remaining in the book as a record. In such books the sheets in each set which are to be torn out are perforated adjacent the binding for ease and neatness of removal, whereas the sheet which is to remain is unperforated.

Conventionally in the manufacture of such books the perforated and unperforated sheets are formed in separate processes which requires the sheets to be collated into the required sets to form them into the book. It is therefore an object of the invention to provide a perforating apparatus for sheet material which permits the perforated and unperforated sheets to be formed in the correct sequence in a single process, thereby eliminating the need for collating.

Accordingly, the invention provides an apparatus for perforating or otherwise locally weakening moving sheet material which apparatus comprising a perforating wheel located adjacent the path of travel of the sheet material, means for pressing the wheel against the moving sheet material so as to effect perforation of the latter, and means for automatically removing the wheel from

contact with the moving sheet material at intermittent intervals so as to temporarily interrupt the perforating operation.

It is to be understood that although the primary application of the invention is the manufacture of docket books, the invention is capable of application in any field where a perforating or similar operation is to be interrupted at predetermined intervals. Furthermore, the local weakening may be accomplished other than by perforating, such as by forming discontinuous slits or holes, top splitting, slitting, sprocket punching or partially cutting through the thickness of the sheet material, and the term perforating is to be construed accordingly.

An embodiment of the invention will now be described with reference to the accompanying drawing whose single figure is a schematic diagram of an apparatus for perforating selected sheets of material from a feed pile.

The apparatus comprises a perforating roller or wheel 10 mounted for rotation on the upper end of an arm 11. The arm 11 is capable of pivoting at its mid-point about a fixed pivot point 12, as indicated by the arrow 13, whereby the wheel 10 may be pressed into contact with a sheet of paper drawn from a feed pile (not shown) past a backing member 14, the path of the paper being indicated by the arrow 15.

The wheel 10 is formed with peripheral pins which, when the wheel is pressed into contact with the paper, punch a line of perforations at least adjacent one longitudinal edge of the paper. The wheel is driven by friction with the moving paper. The paper is drawn past the backing member 14 by any suitable drive means, such as pinch rollers or the like.

The lower end of the arm 11 is pivotally connected at 16 to a piston rod 17, the latter being connected in turn to a piston 18 slidable in a pneumatic cylinder 19. Air under pressure may be supplied to the cylinder 19 via 5 a pipe 20 from a source of compressed air, causing the piston 18 to be driven to the right as viewed in the drawing. The wheel 10 is thereby released from contact with the paper by an anticlockwise rotation as viewed in the drawing of the arm 11 against the bias of a tension 10 spring 21.

The supply of pressurised air to the cylinder 19 is controlled by a resilient valve member 22 connected to a plunger arm 23 of a solenoid 24. The valve member 22 is biassed away from the solenoid 24 by a compression spring 15 25 and when the solenoid is not energised the valve member 22 seals the pipe 20. In such case, the compressed air is not supplied to the cylinder 19. However, when the solenoid 24 is energised the plunger arm 23 and valve member 22 are withdrawn against the bias of the spring 25 thereby allowing the full pressure of the compressed air 20 to be supplied to the cylinder 19. In such circumstances the pressure in the cylinder 19 increases and the piston 18 moves to the right enabling the arm 11 to rotate in an anticlockwise direction (as viewed in the drawing) which 25 acts against the bias of the tension spring 21 thereby disengaging the wheel 10 from the paper.

A control unit 26 comprises a power supply, an active count register, a preselected memory register, and a signal duration unit. It will be appreciated that the 30 latter three items may be incorporated into a single microprocessor unit.

The active count register receives electric pulses via a microswitch 27 and these pulses are counted in the

register. The active count register total is compared with a figure dialled into the preselected memory register. If the registers agree, then an electric signal is supplied to the signal duration unit and the 5 active count register is re-set to zero. A feature of this signal duration is that it can activate the power supply for a preselected time duration.

The microswitch 27 has an outwardly biassed actuator 28 which bears upon and follows the periphery of a cam 10 29. The cam 29 is arranged to rotate one revolution for each sheet of paper drawn past the backing member 14. This may be achieved mechanically in a known manner, for example by operating the cam from the paper drive means via suitable gearing.

15 When the actuator 28 is following the circular part of the cam 28, constituting the major part of the periphery, no electric pulse is supplied via the microswitch 27 to the active count register. However, when the actuator 28 is depressed to a sufficient extent by engagement with a radially outwardly projecting portion 20 31 of the cam periphery, the microswitch 27 supplies a pulse to the active count register.

When the power supply is activated by the signal duration unit, the solenoid 24 is energised, the 25 energisation of the solenoid persisting only for so long as the signal from the signal duration unit persists.

The solenoid 24 when so energised enables the valve member 22 to be withdrawn from the pipe allowing the full air pressure from the compressor to be delivered to the 30 cylinder 19. The air pressure moves the piston 18 rapidly to the right, as shown in the drawing, thereby enabling the wheel 10 to be disengaged from the paper. When the solenoid 24 is no longer energised, the valve

member 22 seals the pipe 20, and the biassing spring 21 enables the wheel 10 to engage the paper. At the same time, air in the pipe 20 between the valve member 22 and the piston 18 is vented to the atmosphere by means of a suitable vent (not shown), so as to enable the piston 18 to move to the left as viewed in the drawing. A stop 32 is provided and arranged so that engagement of the wheel 10 against the paper is sufficient to perforate the paper without damaging the wheel against the backing member 14.

5 Alternatively or additionally, the backing member 14 has a narrow groove to accommodate the path swept out by the pins where they penetrate the paper.

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Thus in the manufacture of docket books in which alternate sheets are to be perforated, the preselected memory register is set to one and the active count register is zeroed. The signal duration unit is programmed so as to activate the power supply for a duration which will correspond to at least the time taken for one sheet of paper to pass the wheel 10.

20 The duration will also be synchronized to the speed of operation of the machine. Such synchronization means are well known. It will also be appreciated that the projecting portion 31 of the cam periphery 30 should be arranged so as to activate the microswitch just as the leading edge of the sheet of paper is about to pass the wheel 10.

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In operation, the first sheet is un-perforated and the cam rotates one revolution thereby supplying a pulse to the active count register. Upon rotation of the cam 30 for the second time, the active count register total and the pre-selected memory register figure are equal, the wheel 10 is engaged instantly to the paper which is about to pass the wheel 10. Thus, that sheet of paper is

perforated. The active count register is reset to zero automatically and the engagement of the wheel 10 is for a duration sufficient to enable the sheet to pass the wheel 10 while being perforated. The solenoid is energised and 5 the wheel 10 is disengaged so that the next sheet of paper is un-perforated. The cycle repeats itself as long as required.

It will be appreciated that by programming the pre-selected count register, a sequence such as one sheet un-perforated and 1, 2, 3, etc., sheets perforated may be successfully completed. (or any other combination required). It will also be appreciated that a continuous length of paper may be drawn past the backing member 14 in the direction of the arrow 15 the paper ultimately 15 being cut transversely into individual sheets and stacked in a known manner for forming into books.

It is to be understood that in the above apparatus, the distance moved by the various components between the perforating and non-perforating states of the apparatus 20 are quite small, and the forces involved relatively large, so that a switching between these states is almost instantaneous.

CLAIMS:

1. An apparatus for perforating or otherwise locally weakening moving sheet material which apparatus comprises a perforating wheel located adjacent the path of travel of the sheet material; means for pressing the wheel against the moving sheet material so as to effect perforation of the latter; and means for automatically removing the wheel from contact with the moving sheet material so as to temporarily interrupt the perforating operation.
2. An apparatus as claimed in claim 1 wherein the wheel pressing means comprises a tension spring and the wheel removing means comprises an electromechanical device including a piston and cylinder arrangement operable by means of a gas fed to the cylinder from an associated gas source.
3. An apparatus as claimed in claim 1 wherein the wheel pressing means comprises an electromechanical device including a piston and cylinder arrangement operable by means of a gas fed to the cylinder from an associated gas source and the wheel removing means comprises a tension spring.
4. An apparatus as claimed in claim 2 or claim 3 wherein the electromechanical device comprises the piston and cylinder arrangement in which the piston has a piston rod which is pivotally connected to one end of an arm, which arm is itself pivotally mounted substantially medially thereof about a fixed point and in which the other end of said arm is connected to the wheel; and means for varying the pressure of the gas in the cylinder to actuate the piston so as to move the wheel into or out

of engagement with the sheet material.

5. An apparatus as claimed in claim 4 wherein the varying means comprises an electrically operable solenoid having operably associated therewith a valve to control
5 the flow of gas into the cylinder.

6. An apparatus as claimed in which the valve is operably connected to the electriclly operable solenoid by means of a plunger arm.

7. An apparatus as claimed in claim 5 or claim 6
10 wherein the solenoid is operatively associated with a switch means controlled by a cam member the movement of which cam member is related to the movement of the sheet material relative to the wheel.

8. An apparatus as claimed in claim 7 which further
15 comprises a control means, which includes a counting register means for recording the number of actuations of the switch means by the cam member and a memory register means for storing a selectable predetermined number so that when the number of actuations and the predetermined
20 number are related in a predetermined fashion, a signal is supplied from the control means to the solenoid so as to operate the valve means.

9. An apparatus substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.